

# The Solar Electric Research Vessel

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Dear Sir,

You may already be aware of the solar electric research vessel that was developed by Peter Thomas of the Central Institute of Technology in Wellington, New Zealand. It is briefly described in the attached paper.

In partnership with an established marine specialist (Dickson Marine (Nelson) Ltd) we have established a company that will take this product through final development and into production. We understand that you may be interested in using this research device, and so we would value your response to the following points.

3. Does your organization have an interest in using this product, and if so what is the main application (eg meteorology, fisheries, etc)?
4. The final price is currently estimated at US\$18,000 per boat, inclusive of all operating and communications systems but no scientific or surveillance payload. At this price, how many boats might you require?
3. Would you prefer to lease boats for specific projects rather than purchase boats?
4. Would you be interested in assisting with in-service testing of a boat, and supplying performance data and characteristics to us, in return for the boat being made available at a reduced hire charge?
5. Would you be interested in investing in the development of this technology, which may lead to a more refined product for your applications and marketing opportunities? Our expectation is that the development costs to full production stage may be of the order of US\$150,000.
6. Are you able to indicate at this time which of the instruments from the attached list you would be likely to fit, and any special instruments that you might like to have carried.

The present status of the project is an advanced working prototype, and we are currently planning a limited production run of between five and ten boats, subject to sufficient demand. We look forward to your response to the above points, and welcome any queries that you may have about the boat.

Kind regards,

Harry Stronach

# The Solar Electric Research Vessel

## Outline

The importance and difficulties of gathering data from remote, and sometimes hostile, oceans is well understood by those involved in this field. The Solar Electric Research Vessel (SERV) is a practical application of modern technology to this problem, and promises cost effective data recovery under continuous control from remote locations. SERV incorporates the following main features:

- Fully enclosed and self righting boat, 4 m long, of Kevlar construction
- Solar panel power collection and battery storage system
- Main propulsion and steering system
- On board control system
- Command system for control from remote base
- Payload capacity for instrument packages
- Special instruments that take advantage of the boat's capabilities
- Complete unmanned operation.

## Mission Applications

SERV can carry the instrument package of your choice and deploy itself to the deep ocean, either on a pre-programmed route or under daily control from a shore base. Data can be returned at regular intervals, depending on satellite system availability. Obvious applications include:

- Meteorological data collection
- Oceanographic research
- Fisheries research and support
- Security operations
- Oil exploration

## Key Advantages

The existing surveillance and data gathering systems over the oceans include manned vessels, moored or drifter buoys, and satellites. SERV introduces a unique combination of features, with ability to carry out complex data collection operations impossible with buoy systems and at a fraction of the cost of manned vessels. The key advantages are:

- Self deploys from a home port
- Station keeping, grid pattern, or shore-base control
- Able to range widely over the worlds oceans
- Versatile payload packages
- Comprehensive backup systems
- Low deployment and running costs
- Comprehensive onboard backup systems
- Returns to home port or rendezvous point on mission completion
- No risks to personnel
- Can be programmed to avoid specific areas

## Technology Applications

The SERV combines elements of proven technology (boat construction, solar panels, etc,) with custom designed energy-management systems, extremely efficient control and propulsion systems, and other innovative responses to the problems associated with small unmanned boats in hostile weather conditions.

The technology is also applicable to, and is available for, other projects. For example the power management systems have more general applications, and the remote control systems can be used on both terrestrial and aviation platforms. A submersible version of SERV is also practical, recharging on the surface by day and exploring underwater by night.

# SERV - Technical Description

## The Boat

|               |  |
|---------------|--|
| Length:       | 4000 mm  |
| Beam:         | 850 mm   |
| Draught:      | 350 mm   |
| Displacement: | 200 kg   |
| Hull type:    | round bilge displacement style, Kevlar construction with bronze fittings |
| Stability:    | self righting under all conditions                                       |

## Performance

|                        |   |
|------------------------|---|
| Typical speed:         | 4.0 kts   |
| Maximum speed:         | 5.5 kts   |
| Operational range:     | from 45° S to 45° N for standard boat, plus higher latitudes during summer                  |
| Endurance:             | unlimited, but annual inspection and calibration recommended                                |
| Turning circle:        | 10 m radius   |
| Station keeping limit: | typically winds of up to 35 kts. Boat returns to station if required when weather moderates |

## Power System

|                       |   |
|-----------------------|---|
| Solar panels type:    | Silicon monocrystalline laser grooved panels, total 6   |
| Solar panel capacity: | 85 W each (510 W total)   |
| Storage batteries:    | Deep cycle 12 V sealed lead acid batteries, total 3 with capacity of 65 Amp hours. Arranged to give 24 V main supply plus 12 V UPS supply |
| Power distribution:   | 100 V AC 10 KHz sine wave type  |
| Electronics supply:   | 100 V AC 10 KHz sine wave type 12 V DC, with UPS  |

Solar panels are fitted with an autotracking system that ensures they always run at maximum power output, and surplus power received during daylight is battery stored to allow continuous night-time operation. An onboard energy management system matches power supply and demand, and there is a backup distribution system that will supply essential services should the main supply fail.

## Propulsion & Steering

|                  |  |
|------------------|--|
| Main propulsion: | Single pulse width modulated permanent magnet DC motor, 250 W rating |
| Control:         | Permanent magnet steering and drogue motors with PWM control         |

## Navigation

Onboard Garmin active antenna GPS with dead reckoning if inadequate satellite coverage. Auto pilot with automatic gain control to allow for varying shaft speeds and the steering loop is closed with a commercial fluxgate compass. Single all round white navigation light with backup bulb.

## Command System

Shore based command and control system with tactile controls is PC based and has 2 way communication with the boat via satellite. The shore controller is able to track boats location, download and analyse data as required, and issue new navigational or data recovery instructions.

## Instrument Options

The boat can be equipped with the instruments and features able to record the following data:

- Water temperature and salinity
- Water turbidity
- Wave height and direction
- Current speed and direction
- Boat speed through water
- Wind speed and direction
- Air temperature and pressure
- Humidity and precipitation
- Digital cameras, above or below water
- Water depth

- Boat speed over ground

In addition, the boat can be equipped with features such as shallow water anchoring, and a winch for towing or lowering transducers, with automatic depth recording. Any other package of instruments or features can be incorporated within the available cargo space.